Analysis Strategy for Differentiating Seismic Foreshocks from Routine Seismic Activity for Early Warning Application

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Introduction

While the analysis of geomagnetic and solar activity offer promising new avenues for anticipating seismic activity given the obvious link between increased solar activity and the induction-driven superheating of magma in the peri-core area, this type of analysis lacks locational specificity and seems to have a high rate of false-positive. A new approach is required to deliver first-in-class earthquake warnings based upon the accurate identification of foreshock events.

Abstract

A false assumption currently frustrating foreshock research is that all foreshocks are caused by the same tectonic shifting that cause the earthquake that they precede. Most studies into foreshocks focus on patterns of relative location of possible foreshocks rather than another, much more useful variable.

I propose that many foreshocks have absolutely nothing to do with the major seismic events they sometimes precede, but that the seismic data associated with those earthquakes may be used to predict an impending major quake. All that is required is that at least one minor quake occur in the operative area within about 72 hours prior to a major quake in order for a reliable prediction of a major quake to be made.

Major quakes are driven by the movement of large sections of the Earth's crust driven by magma pockets pressing up against sections of that crust in unstable areas that are prone to movement i.e. faults. While these magma pockets certainly exert force against these sections of crust (due to flow,) their density is ultimately lower than solid metamorphic rock because their temperature is higher. The movement of these sections of crust is driven by the flow of magma over areas of crust that protrude into parts of the mantle like sails catching the wind. These corrugations or protrusions of crust are the handles by which magma can push against the crust and generate the movement of the earth at surface level.

When a small-to-moderate earthquake occurs at a time and location when/where a magma pocket has risen to a relatively shallow depth, the seismic waves projected by the smaller quake will diffuse differently than if solid rock were beneath the operative site. The comparatively low density of magma will result in the reflection of the seismic waves in a particular pattern. Rather than this reflection registering as increased seismic activity after the fact (i.e. an echo,) this sort of reflection should present itself as decreased background noise

pursuant to the foreshock event lasting for perhaps 30 seconds after the end of the detectable seismic activity.

Reflected seismic energy from the smaller quakes would, when reflected from a lower-density liquid layer be diffused in focus and would feature pockets of acoustic self-cancellation that would also annihilate ambient acoustic noise ordinarily picked up by seismometers. This effect would manifest itself as a decrease in the total count of seismic perturbations during the 30-second window after the end of apparent seismic activity.

Conclusion

While ordinarily, no acoustic energy would be reflected from the lower layers of crust and mantle, the reflected acoustic energy that results from the presence of low-density liquid magma at a shallower-than-normal depth actually results in a decrease in perturbation count in the case of those quakes that we have come to regard only after the fact as "foreshocks."